

## STABILIZER-SEAL-INSERT FOR PUSH-IN TUBE COUPLINGS

This application claims priority to provisional application no. 60/439053 filed January 8, 2003, and provisional application no. 60/445363 filed February 5, 2003.

### Field of the Invention.

5       The field of the invention is tube couplings, especially push-in plastic tube couplings.

### Background

10       Push-in tube couplings (also known as stab-type couplings) typically employ a sliding collet to hold a pipe or other tube in a sleeve. The collet contains inwardly facing claws or teeth that engage the exterior surface of the tube, and thereby oppose a pullout force on the tube. The engagement can usually be released by sliding the collet into the coupling, towards the proximal end of the tube. Sealing in push-in tube couplings is provided by one or more "O"-rings positioned between the exterior surface of the tube and the inner surface of a sleeve portion of the coupling.

15       Push-in tube couplings are readily available in inline, elbow, T, and tube closures configurations. Such couplings have the advantage of quick connection / disconnection, and are often able to withstand significant pressures and relatively high temperatures.

20       Because push-in couplings are designed to be releasable, the seal is necessarily impermanent. Indeed, the seal can often be comprised in a fairly simple manner, such as by using tubing that has a deformed end, or excessively flexing the tubing near the coupling. These problems have been addressed in various ways, including increasing the axial length of the sleeve, and by inserting a stiffener into the inserted end of the tubing. In the latter case, it is known to utilize stiffeners that are fitted to the tubing prior to insertion into the sleeve (extrinsic stiffeners), and also to provide couplings in which the stiffener forms part of the coupling (integral stiffeners). Examples are shown in Volgstadt et al. patents 4282175 and 4229025 (Aug. 1981 and Oct. 1980, respectively), the disclosures of which are incorporated herein by reference.

30       Although use of the known stiffeners solves the flexing problem, they do little or nothing to improve the seal in properly aligned tubes. John Guest™ has developed a system that uses tube inserts that have secondary seals around the insert. The company's STS line of Superseal™ pipe inserts (STS10, STS15, etc) has a first "O" ring that seals between the outer

circumference of the insert and the inner wall of the tube, and a second "O" ring that seals between the outer circumference of the insert and the inner wall of the coupling sleeve. The problem, however, is that those known inserts must all be fitted into the tube before the tube is installed in the coupling. That requirement allows the seals on the inserts to be  
5 compromised, by physical damage, dirt particles, and so forth. The prior art is apparently devoid of teachings where the tube insert is pre-installed into the coupling.

Thus, there is still a need to provide a tube insert for a push-in type tube coupling that is pre-installed into the coupling.

### **Summary Of The Invention**

10 The present invention provides a factory pre-installed tube insert for a push-in type tube coupling. The insert can be integrally formed as part of the coupling, or included as a separate piece in the coupling.

The insert preferably has at least one secondary seal, which is advantageously disposed around the base of the insert and/or around the shaft of the insert. The base is  
15 preferably chamfered base to facilitate insertion of the insert into the coupling, and can advantageously have a shoulder that cooperates with a retaining ring of the coupling to impede accidental removal of the insert from the coupling.

The seals are preferably "O" rings, of any suitable size and material.

Various objects, features, aspects and advantages of the present invention will become  
20 more apparent from the following detailed description of preferred embodiments of the invention, along with the accompanying drawings in which like numerals represent like components.

### **Brief Description Of The Drawing**

Figure 1 is a vertical cross-section of a coupling having an integral stiffener.

25 Figure 2 is a vertical cross-section of the stiffener of figure 1.

### **Detailed Description**

Figure 1 generally depicts a coupling 1 into which has been inserted tube 2.

Coupling 1 generally includes a body 10 with integrally molded sleeve portions 12A and 12B and end caps 14A, 14B, and collets 16A, 16B. Tube 2 is inserted in to sleeve 12B.

Each of the sleeves 12A, 12B has a primary "O"-ring 18A, 18B, a washer 20A, 20B, a tube stop 22A, 22B, and shoulders 24A, 24B, respectively. "O" rings 18A, 18B, which are supported and positioned by the corresponding internal shoulders 19A, 19B in the coupling 1, are considered "primary" because they seal a tube directly against the coupling. Specifically with respect to sleeve 12B, "O" ring 18B simultaneously engages the outer surface of tube 2 and the inner surface of sleeve 12B to form an air and liquid-tight seal around the outer surface of tube 2. Tube stop 22B limits the depth to which tube 2 can be inserted into sleeve 12C. The washers 20A, 20B protect the corresponding "O" rings 18A, 18B from coming in contact with the respective collets 16A, 16B during insertion of a tube.

Each of the end caps 14A, 14B has a tapered inner cam surface 15A, 15B that receives one of the collets 16A, 16B. Each of the collets 16A, 16B has a plurality of circumferentially disposed resilient arms 17A, 17B with claws or teeth (not shown) for holding a tube. In the example shown, collet 16B is compressed against tube 2 by a slight withdrawal of the tube 2 from the coupling 1. The tube 2 can be released by depressing collet 16B back towards the inserted end of the tube.

Although both sleeves 12A, 12B could well include a stiffener, the drawing is simplified by showing only sleeve 12B as having a stiffener, referred to herein as stabilizer seal insert 30. Insert 30 has an outside diameter that approximates the inside diameter of the tube 2. As further shown in **Figure 2**, insert 30 also generally includes a stem 32 having a base 34, and a retaining indentation or race 36 that receives a secondary "O"-ring 38. The "O"-ring 38 provides a seal between the inner surface of the tube 2 and the outer surface of insert 30. Insert 30 also contains another secondary "O"-ring 40, situated near the base of the insert. "O"-ring 40 seals the outer surface of insert 30 against the inner surface of the base of sleeve 12B. Only one of secondary "O"-rings 38, 40 is needed, but inclusion of both is preferred.

There are significant advantages to utilizing one or both of secondary "O" rings 38, 40 in conjunction with an insert 30. Many of the known push-in couplings tend to leak if the tube is bowed at or near the coupling, if the end of the tube is not completely inserted into the coupling, or if the tube's "O"-ring is dirty or damaged. As a result, quick connect couplings of

this type are not widely used in a manufacturing environment, including especially that for marine and RV applications. This problem occurs even where the tube insert is fitted with secondary seals, since those seals can be compromised in storage and during the process of fitting the insert into the tube. With the presently disclosed embodiments, the insert is pre-installed into the coupling, and is thereby protected during storage. The inventive inserts have one or both of the secondary "O" rings 38, 40 to help prevent leaks where the primary "O"-rings 18A, 18B are compromised, and those secondary seals would tend to be protected from damage or dirt during insertion of the tube into the coupling. These rings are considered "secondary" because they seal something other than the tube directly against the coupling.

In Figure 1 insert 30 can be viewed as being integrally molded with sleeve 12B. In less preferred embodiments insert 30 could be inserted into end of a tube prior to insertion of the tube into the coupling 1. In that latter situation, such as would be the case with use of sleeve 12A, the base of the insert would typically seat against tube stop 22A when the tube is inserted into the sleeve. Under high pressure, the insert 30 may then travel inside the sleeve 12A from the tube stop 22A to the internal shoulder 24A. "O"-ring seal 40 would then advantageously prevent liquid and gasses from passing between the base of the insert 30 and the inner surface of the sleeve 12A.

There is a second possibility for pre-installation of the tube insert. Instead of insert 30 being integrally molded into coupling 1, or inserted into the tube prior to insertion of the tube into the coupling, insert 30 could be fitted into the coupling as a separate piece. To that end base 34 of insert 30 has a chamfer 42 that facilitates insertion of the insert 30 through the "O"-ring 18A during assembly of the coupling. There is a concern in this third scenario that insert 30 may be accidentally pulled out of the sleeve 12A when the tube is removed from the coupling. To impede that eventuality, a retaining ring 26A, 26B is disposed into sleeves 12A, 12B, respectively, in a position that cooperates with a shoulder 35 of base 34 to prevent such removal.

It should be appreciated that the various "O" rings described herein, 18A, 18B, 38, 40, can advantageously comprise rubber, silicone, sanoprene at about 60 shore, or any other suitably deformable material or materials. In conjunction with the description herein, selection of the particular materials used, as well as the sizes used, lies well within the skill of those in the field. There may also be other types of seals that would satisfy the various

requirements stated or implied herein, so that the term "O" rings is intended to include all such seals. For example, the entire insert 30, including integrally molded circumferential bosses, can be sanoprene or similar material, preferably at a hardness of about 80 shore. In that manner the integrally molded circumferential bosses substitute for separately installed "O" ring parts, saving on costs.

It should also be appreciated that use of the term "tube", or what is regarded herein as its equivalent, "tubing", contemplates all manner of tube, including especially those comprising polyvinyl chloride (PVC), polyurethane, polypropylene, and/or all other suitable polymer materials. A wide range of tube sizes is also contemplated, including those having external diameters from 2 mm to 30 mm, inclusive.

In a similar manner, contemplated couplings and inserts can be made from any suitable material, and have any suitable size and configuration. It is especially contemplated that couplings include inline, elbow, T, and tube closures configurations.

Thus, specific embodiments and applications have been disclosed for an improved tube coupling system in which the end of a tube is fitted over a stiffening member that includes at least one secondary seal. It should be apparent, however, to those skilled in the art that many more modifications besides those already described are possible without departing from the inventive concepts herein. Moreover, in interpreting the disclosure, all terms should be interpreted in the broadest possible manner consistent with the context. In particular, the terms "comprises" and "comprising" should be interpreted as referring to elements, components, or steps in a non-exclusive manner, indicating that the referenced elements, components, or steps may be present, or utilized, or combined with other elements, components, or steps that are not expressly referenced.